Emerging Visualization Techniques: "Getting it at a Glance"

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FHWA Webinar: Using Visualization Techniques to Communicate Transportation Planning Data

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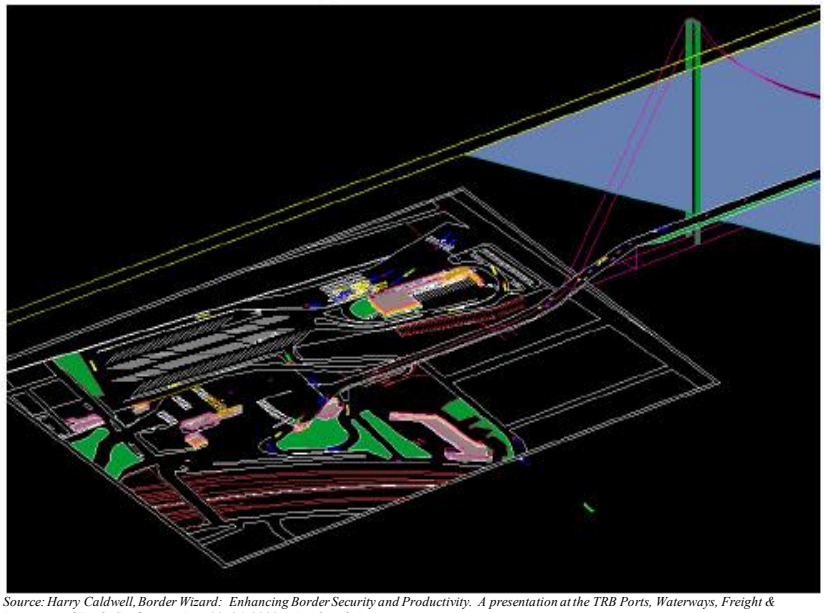
Welcome to the "Viz Age!"

- ***Called for explicitly in SAFETEA-LU***
- ***Not new – not even the term***
- ***Gaining popularity***
  - ***No standards or guidelines on use and benefits***
- ***Fifth International Visualization in Transportation Symposium and Workshop***
  - ***October 2006***

Visualizations to educate the public on future projects – "just like being there"

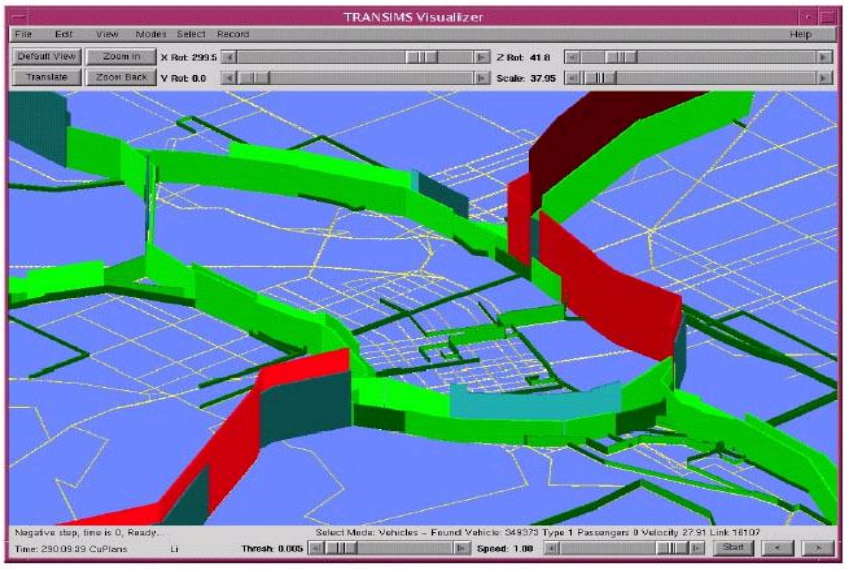
Source: Charles L. Hixon III, Visualization for Project Development: A Synthesis of Highway Practice, Transportation Research Board, Washington, D. C. 2006. p. 13

Visualizations to illustrate complex operations – " just how will it work for us?"



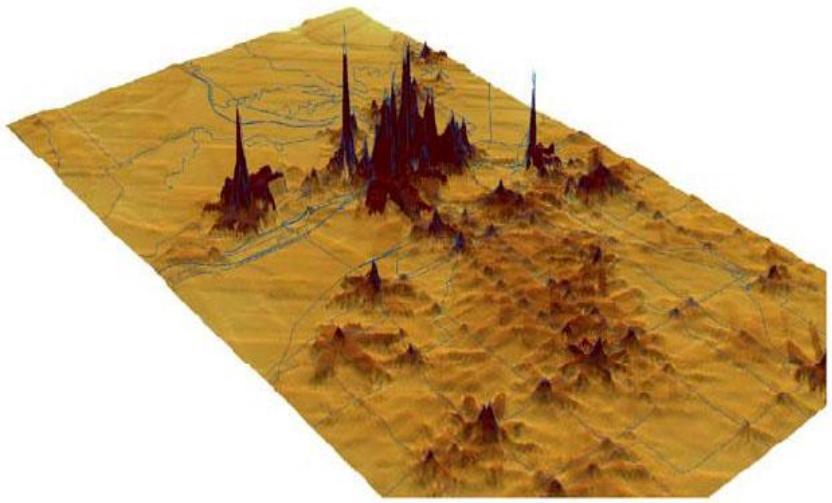
Source: Harry Caldwell, Border Wizard: Enhancing Border Security and Productivity. A presentation at the TRB Ports, Waterways, Freight & International Trade Conference, June 23 -26, 2002 in Pittsburgh, PA.

Visualizations to "explain" the output from microsimulation models



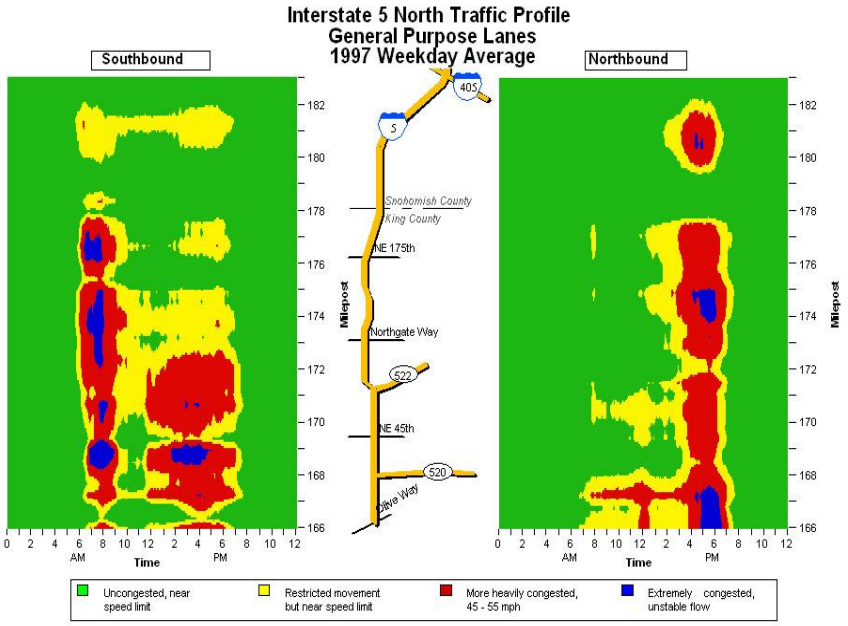
Source: Travel Model Improvement Program (TMIP) http://www.ccs.lanl.gov/transims/features.shtml

Visualizations of performance from actual GPS/APC transit data using 3-D GIS



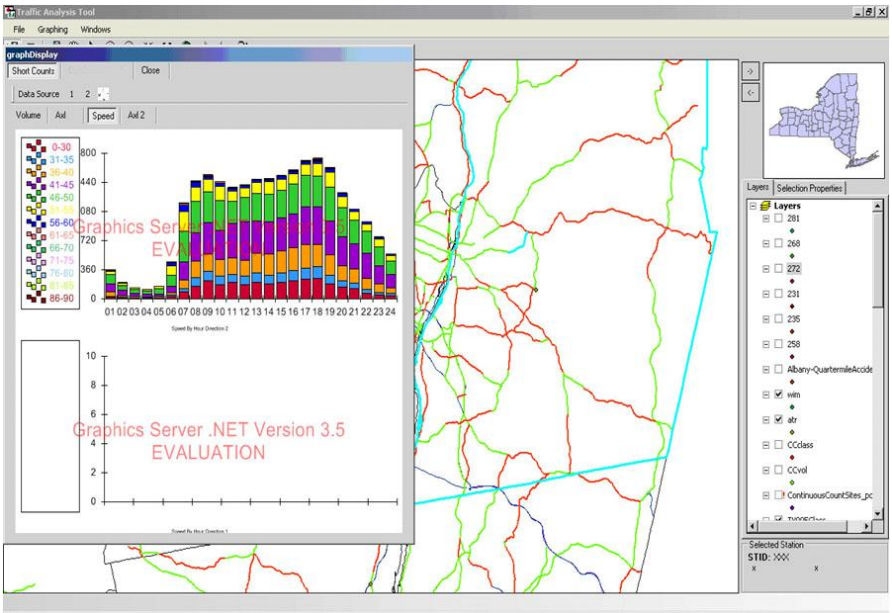
Source: Thomas J. Kimpel, Data Visualization as a Tool for Improved Decision Making within Transit Agencies. Final Technical Report TNW2006-14. A report prepared for Transportation Northwest (TransNow), University of Washington, Seattle, WA, 2007, p. 27.

Visualizations of congestion using archived ITS traffic data



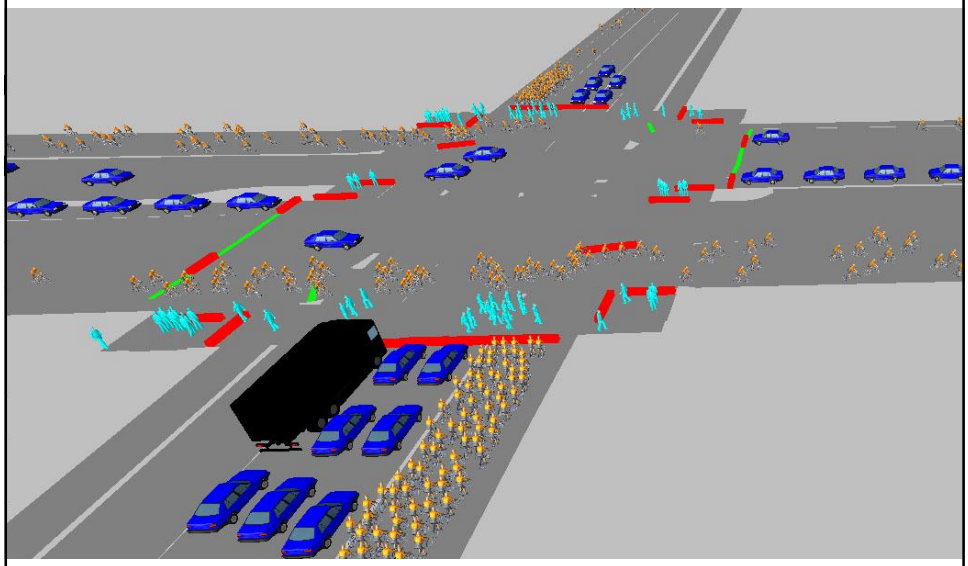
Source: Mark Hallenbeck, University of Washington/TRAC. 1999.

Visualizations for "user-directed" exploration using ArcEngine/GIS and archived ITS



Source: Adapted from Catherine Lawson and Alex Muro, Visualization Tool Development: Using GIS and Archived Traffic Data in a New Environment of Functionality. A report prepared for the Office of Policy and Strategy, New York State Department of Transportation, Albany, New York, 2007.

Visualizations using animation technologies to illustrate multi-modal interactions



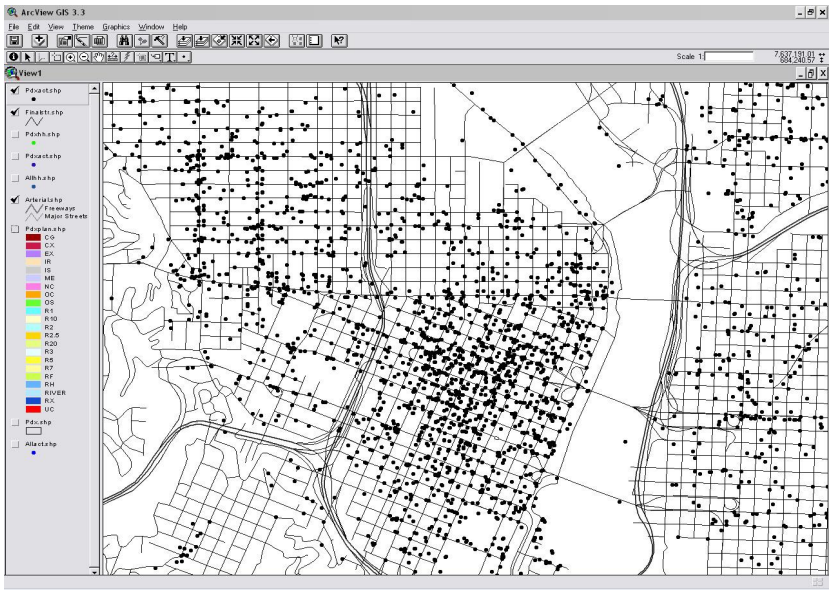
Source: VISSIM 5.10-04 Demo "UrbanIntersection_Bejing.CN/beijin.inp, November 7, 2008.

Visualizations for the Travel Survey Community

Opportunities

- *"Recycling" flat files from previous travel surveys with lat/long data (geocoded)*
- *Every activity can be explicitly examined in the context of a GIS environment (e.g., all the other GIS files available in the region – parcel data, zoning, environmental data, etc.)*

Visualizations of 1996-97 Portland/Metro Activity Data in GIS –
Each point is an activity location with all the associated attributes available for analysis

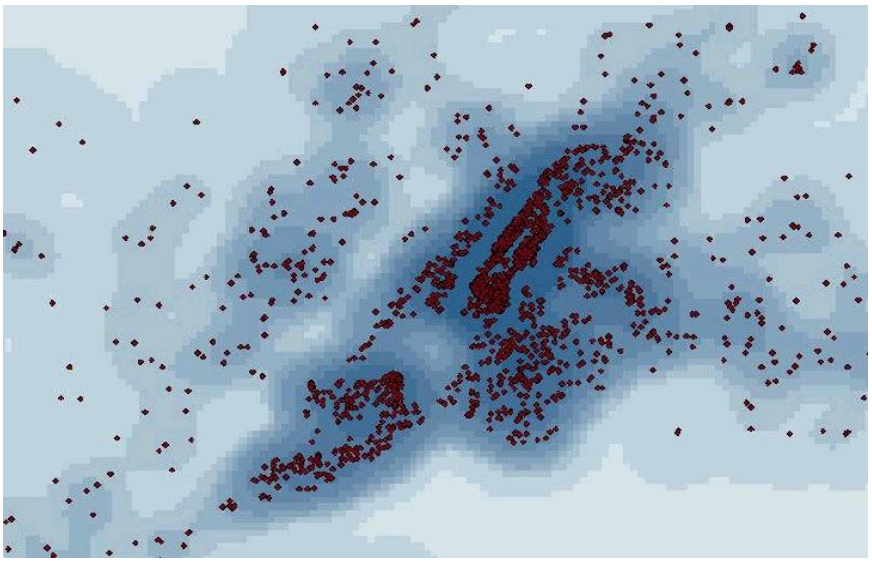


Source: Data provided by METRO, Portland, Oregon. 1998.

– Exploring previous data problems

- ***Mis-reported transit trips – where did the survey participants live?***
- ***Are there any patterns in the mis-reported trips?***
- ***Can we learn more about the problem before the next deployment?***

Visualizations of household locations with mis-reported transit trips in the 1997 NYMTC Regional Household Travel Survey using a "density" technique

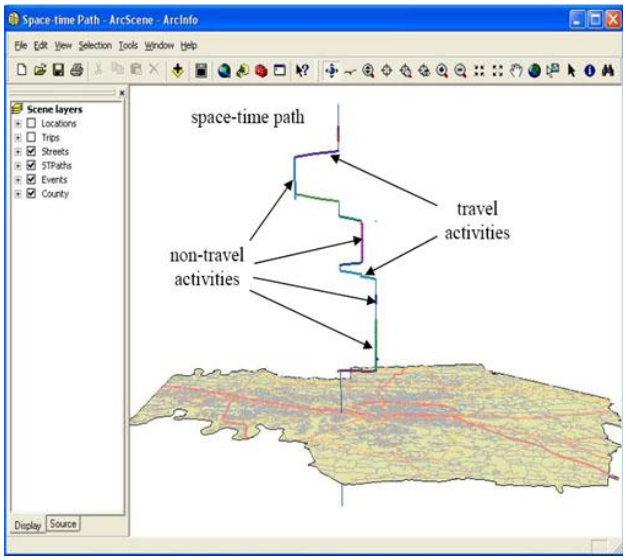


Source: Data provided by NYMTC. 2007.

– ***Exploring activity sequencing strategies***

- ***Where in the region were people involved in particular activities?***
- ***In what order did they sequence their activities?***
- ***What other spatial attributes should be included in the analysis?***

Visualizations of space-time path to understand the relationship of activities



Source: Hongbo Yu. Visualizing and Analyzing Activities in an Integrated Space-time Environment: Temporal GIS Design and Implementation. A paper presented at the Annual Transportation Research Board Meetings, January21-25, 2007, in Washington, D. C.

- ***Using Global Positioning Systems (GPS)***
  - ***With (or without) a diary provides an opportunity to examine spatial data in Google Earth and geographic information systems (GIS)***
  - ***Auditing equipment performance by staff***
  - ***Auditing and annotating activities by survey participant***
  - ***Validating model outputs with "real" data***
  - ***Illustrating "the problem" to decision makers***

Visualizations of mode changes using GPS

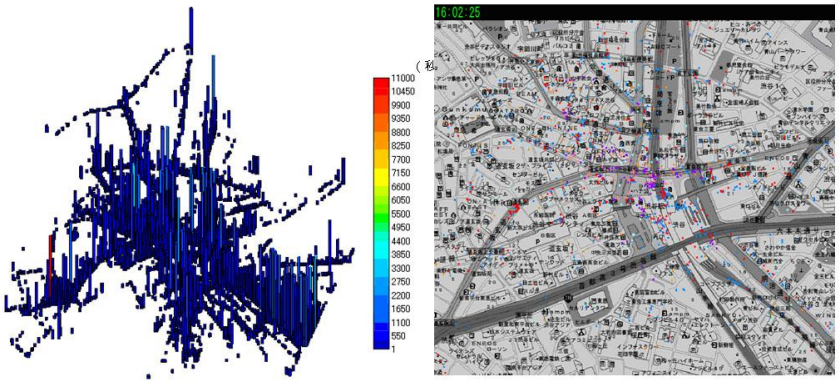
KML file format used first in Google Earth, and then converted to GIS

Source: C. Lawson, C. Chen, and H. Gong, GPS Pilot Study. A presentation at the Travel Survey Workshop, January 8, 2008, in New York City, New York.

- ***Examining the density of activities and aggregate levels of movement using cell phone and other probe data***
  - ***Data mining for emerging travel patterns***
  - ***New "vision" of activity patterns***

Advanced visualizations using extended collection periods

Observation of pedestrian excursion trip



Expended hours on each links

Raw trajectory data in Sibuya down town area (Tokyo)

Source: Eiji Hato, Behavioral data mining using auto ethnographical data collected through the Probe Person System, presented at the Travel Survey Methods New Technology Subcommittee on January 23, 2007, in Washington, D. C.

But what about…….???

- ***Issues with privacy***
- ***Issues with "fuzzying-up" the data (e.g., too much or too little)***
- ***Issues with ownership and retention of data***
- ***Should the data provider (the survey participant) be able to choose a "provider-defined" release strategy?***

What will it take to move forward?

- ***Visualization for travel surveys will require new data asset management strategies***
  - ***Good stewardship practices***
  - ***Standards for handling and maintaining data***
    - ***New meta data practices – (e.g. "ride along" concept)***
    - ***Full sample harvest archive***
    - ***Dissemination software to reduce "user" burden***

What else will it take to move forward?

- ***Visualization will require a new form of participatory research***
  - ***"Computer Science meets Transportation"***
    - ***New methods of internal processing and post-processing of the data for visualization outputs***
    - ***New contracting strategies to bring end-user closer to experimental stages of the research***
    - ***Clear avenues for feedback during the research process to ensure "knowledge" goals from visualization strategies – when developers have the most flexibility to respond***

And what else ….?

Visualization processes should be developed in an Open Source/Open Architecture Environment

- ***High risk of IT upgrades and hardware changes***
  - ***Requiring at least one version to be "open" to reduce risk of IT creep***
  - ***Possible advantages for more rapid development with OS community***

What are the emerging roles?

Survey Participant Role

- ***Data Generation and Collection***
  - ***Willingness to participate in surveying efforts (convinced of value)***
  - ***Able to answer questions and use equipment***
  - ***Able to "audit" their own data for accuracy (cost-effective approach to improve data quality)***
- ***Data Preservation***
  - ***Possible levels of data release ("provider-defined" release options)***

What are the emerging roles?

Private Sector Consultants

- *Data Generation and Collection*
  - *Advance capabilities and market shares with improved techniques*
  - *Increase work flow using visualization for internal work products*
- *Data Preservation*
  - *Cooperation in data archiving program, with revenue considerations*

What are the emerging roles?

Public Sector Agencies

- *Data Generation and Collection*
  - *More transparency and oversight of consultants with shared internal visualization of survey progress*
  - *Requirement of at least one OS version*
  - *Make funding available in new forms of interactive research format*
- *Data Preservation*
  - *Establish standards for data formats – but not for post-processing or output*
  - *Provide funding for research-to-practice experiments to advance use of visualization from archived data*

And finally!!!!

Visualization for the travel survey community will need continued support from TRB and international organizations

- ***Need for a forum for the exchange of ideas and sharing of "lessons learned"***
- ***Reduction in risk of repeating an already "learned lesson" -- the hard way***
- ***Providing a "real time" dialogue for the travel survey community to promote visualization***